CLAIMS

What is claimed is:

1. An ophthalmic adaptive-optics instrument for obtaining patient-verified prescription of low and high-order aberrations, comprising:
   an observation target disposed for a subject eye to fixate upon;
   an aberration-compensating element disposed in the observation path of said subject eye, wherein said aberration-compensating element is driven by a control signal and is capable of compensating low and high-order aberrations of said subject eye;
   a wavefront-sensing device sensing the aberration of said subject eye via said aberration-compensating element;
   processing electronics coupled to said wavefront-sensing device and accepting a command signal to generate said control signal to drive said aberration-compensating element; and
   subjective feedback control means enabling the patient to actively produce said command signal to adjust said aberration-compensating element and to verify the amount of aberration compensation for optimal visual acuity;
   wherein said ophthalmic adaptive-optics instrument can measure the total aberration of said subject eye, corresponding to a null command signal, and the residual aberration for optimal visual acuity, corresponding to a command signal for optimal visual acuity; and
   wherein said ophthalmic adaptive-optics instrument provides, by subtracting said residual aberration from said total aberration, said patient-verified prescription of low-and-high order aberrations.

2. An ophthalmic adaptive-optics instrument of claim 1, wherein said aberration-compensating element is a deformable mirror.

3. An ophthalmic adaptive-optics instrument of claim 1, wherein said aberration-compensating element consists of a deformable mirror and a set of compensation lenses.

4. An ophthalmic adaptive-optics instrument of claim 1, wherein said aberration-compensating element is a spatial phase modulator.

5. An ophthalmic adaptive-optics instrument of claim 1, wherein said wavefront-sensing device is a Hartmann-Shack wavefront sensor.

6. An ophthalmic adaptive-optics instrument of claim 1, wherein said wavefront-sensing device is a curvature wavefront sensor.

7. A method for obtaining patient-verified prescriptions of low and high-order aberrations, comprising the steps of:

providing an observation target for a subject eye to fixate;

providing an aberration-compensating element disposed in the observation path of said subject eye, wherein said aberration-compensating element is driven by a control signal and is capable to compensate low and high order aberrations of said subject eye;

providing a wavefront-sensing device to sense the aberration of said subject eye via said aberration-compensating element;

providing processing electronics coupled to said wavefront-sensing device and read in a command signal;

generating said control signal to drive said aberration-compensating element;

providing subjective feedback control means to enable the patient actively to produce said command signal to adjust said aberration-compensating element and to verify the amount of aberration compensation for optimal visual acuity;

measuring the total aberration of said subject eye, corresponding to a null command signal;

measuring the residual aberration for optimal visual acuity, corresponding to a command signal for optimal visual acuity; and

determining said patient-verified prescription of low-and-high order aberration by subtracting said residual aberration from said total aberration.

8. A surgical station for customized corneal ablation using a patient-verified prescription of low-and-high order aberration, comprising:

An ophthalmic adaptive-optics instrument providing a patient-verified prescription of low and high-order aberrations, wherein said patient-verified prescription indicates the amount of aberration correction needed for optimal visual acuity of the subject eye;

A system computer connected operationally to said ophthalmic adaptive-optics instrument and calculating an ablation profile in accordance with said patient-verified prescription; and

A surgical laser system producing a surgical laser beam and having a beam scanning mechanism to scan said surgical laser beam in a controllable fashion;

wherein said system computer scans said surgical laser beam of said surgical laser system to produce a customized ablation profile on the cornea of said subject eye to achieve aberration correction in accordance with said patient-verified prescription.

9. A surgical station as in Claim 8, wherein said ophthalmic adaptive-optics instrument consists of an

aberration-compensating element.

10. A surgical station as in Claim 8, wherein said ophthalmic adaptive-optics instrument consists of a deformable mirror.

11. A surgical station as in Claim 8, wherein said ophthalmic adaptive-optics instrument consists of wavefront-sensing device.

12. A surgical station as in Claim 8, wherein said ophthalmic adaptive-optics instrument consists of Hartmann-Shack wavefront sensor.

13. A surgical station as in Claim 8, wherein said ophthalmic adaptive-optics instrument consists of a curvature wavefront sensor.

14. A surgical system as in Claim 8, wherein said surgical laser system includes an excimer laser operating at a wavelength of 193 nm.

15. A surgical system as in Claim 8, wherein said surgical laser system includes a solid state UV laser operating at a wavelength around 210 nm.

16. A surgical system as in Claim 8, wherein said surgical laser system includes a solid state UV laser operated at a pulse rate between 200 to 2000 Hz.

17. A surgical system as in Claim 8, wherein said surgical laser system includes an eye-tracking device.

18. A method for custom lens making, comprising the steps of:

providing an ophthalmic adaptive-optics instrument to produce patient-verified prescription of low-and-high order aberrations, wherein said patient-verified prescription indicates aberration correction needed for optimal visual acuity of a subject eye;

providing a system computer connected operationally to said ophthalmic adaptive-optics instrument and calculating an ablation profile in accordance with said patient-verified prescription; and

providing a lens making station coupled to said system computer;

wherein said system computer guides said lens making station to produce a custom lens that embeds optical correction in accordance with said patient-verified prescription of low and high-order aberrations.

19. A method as in Claim 18, wherein said lens making station employs laser ablation to create a custom profile on a surface of said custom lens.

20. A method as in Claim 18, wherein said custom lens includes custom contact lens, custom eyeglasses, and custom intra-ocular lens.